

## CLAIMS

What is Claimed is:

1. A data cache comprising:

a plurality of cache lines, each cache line including a state indicator for

5 indicating anyone of a plurality of states, wherein said plurality of states includes a speculative state to enable keeping track of speculative modification to data in said respective cache line, wherein said speculative state enables a speculative modification to said data in said respective cache line to be made permanent in response to a first operation, and wherein said speculative state enables said  
10 speculative modification to said data in said respective cache line to be undone in response to a second operation.

2. The data cache as recited in Claim 1 wherein said plurality of states includes an invalid state, a dirty state, and a valid state.

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3. The data cache as recited in Claim 1 wherein said first operation is a commit operation.

4. The data cache as recited in Claim 1 wherein said second operation is a  
20 rollback operation.

5. The data cache as recited in Claim 1 wherein before speculatively modifying a cache line that is in a dirty state, said cache line is cleaned by writing back to memory the dirty data of said cache line.

5 6. A system comprising:  
a data cache comprising a plurality of cache lines, each cache line including a state indicator for indicating anyone of a plurality of states, wherein said plurality of states includes a speculative state to enable keeping track of speculative modification to data in said respective cache line, wherein said speculative state  
10 enables a speculative modification to said data in said respective cache line to be made permanent in response to a first operation, and wherein said speculative state enables said speculative modification to said data in said respective cache line to be undone in response to a second operation; and

15 a speculative cache buffer for receiving cache lines which are evicted from said data cache and have one of a second plurality of states.

7. The system as recited in Claim 6 wherein said plurality of states includes an invalid state, a dirty state, and a valid state, and wherein said second plurality of states includes said speculative state and said dirty state.

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8. The system as recited in Claim 6 wherein said first operation is a commit operation.

9. The system as recited in Claim 6 wherein said second operation is a rollback operation.

10. The system as recited in Claim 6 wherein before speculatively modifying  
5 a cache line that is in a dirty state in said data cache, said cache line is evicted to said speculative cache buffer.

11. The system as recited in Claim 6 wherein each cache line in said speculative cache buffer includes a second state indicator for indicating anyone of a  
10 plurality of second states, said plurality of second states includes a particular state to indicate that said data cache has evicted said respective cache line that has dirty data in response to a speculative modification operation to said respective cache line in said data cache.

12. The system as recited in Claim 6 wherein said speculative cache buffer is  
15 fully associative.

13. A system comprising:  
a data cache comprising a plurality of cache lines, each cache line including a  
20 state indicator for indicating anyone of a plurality of states, wherein said plurality of states includes a speculative state to enable keeping track of speculative modification to data in said respective cache line, wherein said speculative state enables a speculative modification to said data in said respective cache line to be made

permanent in response to a first operation, and wherein said speculative state enables said speculative modification to said data in said respective cache line to be undone in response to a second operation; and

a processor operative to perform a speculative store operation to said data

5 cache.

14. The system as recited in Claim 13 wherein said first operation is a commit operation.

10 15. The system as recited in Claim 13 wherein said second operation is a rollback operation.

16. The system as recited in Claim 13 wherein before speculatively modifying a cache line that is in a dirty state, said cache line is cleaned by writing back  
15 to memory the dirty data of said cache line.

17. The system as recited in Claim 13 further comprising a speculative cache buffer for receiving cache lines which are evicted from said data cache and have one of a second plurality of states.

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18. The system as recited in Claim 17 wherein said plurality of states includes an invalid state, a dirty state, and a valid state, and wherein said second plurality of states includes said speculative state and said dirty state.

19. The system as recited in Claim 17 wherein before speculatively modifying a cache line that is in a dirty state in said data cache, said cache line is evicted to said speculative cache buffer.

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20. The system as recited in Claim 17 wherein each cache line in said speculative cache buffer includes a second state indicator for indicating anyone of a plurality of second states, said plurality of second states includes a particular state to indicate that said data cache has evicted said respective cache line that has dirty data in response to a speculative modification operation to said respective cache line in said data cache.

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21. The system as recited in Claim 17 wherein said speculative cache buffer is fully associative.

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22. A method of managing speculative data modifications in a data cache, said method comprising:

in response to a speculative modification to data in a cache line, setting a state indicator of said cache line to a speculative state;

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if said speculative modification to said data is desired to be made permanent, changing said state indicator to a first state in response to a first operation; and

if said speculative modification to said data is desired to be undone, changing said state indicator of said cache line to a second state in response to a second operation.

5           23.    The method as recited in Claim 22 wherein said first state is a dirty state.

24.    The method as recited in Claim 22 wherein said second state is a invalid state.

10           25.    The method as recited in Claim 22 wherein said first operation is a commit operation.

26.    The method as recited in Claim 22 wherein said second operation is a rollback operation.

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27.    The method as recited in Claim 22 wherein before speculatively modifying a cache line that is in a dirty state, said cache line is cleaned by writing back to memory a dirty data of said cache line.

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28.    A method of managing speculative data modifications in a speculative cache buffer, said method comprising:

receiving from a data cache a cache line in a speculative state and having speculative modification to the data within said cache line;

setting a state indicator of said cache line to a speculative state in said speculative cache buffer;

5 if said speculative modification to said data is desired to be made permanent, changing said state indicator to a first state in response to a first operation; and

if said speculative modification to said data is desired to be undone, changing said state indicator of said cache line to a second state in response to a second operation.

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29. The method as recited in Claim 28 wherein said first state is a dirty state.

30. The method as recited in Claim 28 wherein said second state is an invalid state.

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31. The method as recited in Claim 28 wherein said first operation is a commit operation.

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32. The method as recited in Claim 28 wherein said second operation is a rollback operation.

33. A method of managing speculative data modifications in a speculative cache buffer, said method comprising:

receiving from a data cache a cache line in response to a speculative  
modification of data in said cache line within said data cache;

setting a state indicator of said cache line to a commit-kill state in said  
speculative cache buffer;

5           if said speculative modification to said data is desired to be made permanent,  
changing said state indicator to a first state in response to a first operation; and

if said speculative modification to said data is desired to be undone, changing  
said state indicator of said cache line to a second state in response to a second  
operation.

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34.   The method as recited in Claim 33 wherein said first state is an invalid  
state.

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35.   The method as recited in Claim 33 wherein said second state is a dirty  
state.

36.   The method as recited in Claim 33 wherein said first operation is a  
commit operation.

20           37.   The method as recited in Claim 33 wherein said second operation is a  
rollback operation.